

Some Recent Facts about SARS-CoV-2

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Received: March 23, 2020

Published: April 08, 2020

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Corona viruses are the largest group of virus belonging to the class Nidovirales. Corona viruses (CoVs) are enveloped positive sense single stranded RNA viruses. They are characterized by club-like spikes that project from their surface, an unusually large RNA genome, and a unique replication strategy (Figure 1). Corona viruses causes a variety of diseases in mammals and birds ranging from enteritis in cows and pigs and upper respiratory diseases in chickens to potentially lethal human respiratory infections. The corona gets its name due to the spike like projections which gives it the appearance of solar rays or solar corona [1].

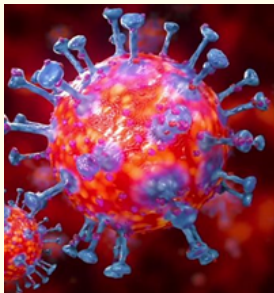


Figure 1: Corona virus.

Types of corona viruses

Depending upon the host to be infected, corona virus are of different types: Animal corona viruses and human corona viruses. The following list shows the types of corona viruses which infects animals [1]:

- Transmissible gastroenteritis virus (TGEV)- Gastroenteritis in young piglets.
- Porcine epidemic diarrhea virus (PEDV)- Gastroenteritis in young piglets.
- Porcine haemagglutinating encephalomyelitis virus (PHEV)- Enteric infection in pigs affecting nervous system.
- Feline enteric coronavirus (FCoV)- infection in cats.
- Bovine CoV- respiratory infection in cattle.

- Rat CoV- respiratory infection in rats.
- Bat CoV- respiratory infection in bats.
- Murine hepatitis virus (MHV)- neurologic infections in mice.

The human corona viruses are of four types: alpha, beta, gamma and delta. Out of which, the two forms- alpha and beta are most common to cause infections in humans [2]:

- 229E alpha coronavirus
- NL63 alpha coronavirus
- OC43 beta coronavirus
- HKU1 beta coronavirus.

These forms of corona viruses cause mild symptoms like cold and cough. Whereas other corona viruses:

- SARS CoV beta coronavirus (Severe acute respiratory syndrome)
- MERS CoV beta corona virus (Middle east respiratory syndrome)
- SARS Cov 2 beta corona virus (Severe acute respiratory syndrome 2 novel corona virus- COVID 19).

These forms show severity of symptoms affecting upper respiratory tract in humans and are known to be pandemic. In 2003 - 2004, there occurred an epidemic disease caused by SARS-CoV affecting 8,098 people worldwide and causing severe acute respiratory syndrome. In 2012, another MERS-CoV became pandemic in middle-eastern countries causing respiratory diseases in around 2,519 people till January 31, 2020. Now, another form of SARS-CoV 2 has emerged in December 2019 from China causing COVID-19 (corona virus respiratory disease) that became pandemic and has affected 3,08,540 people worldwide till 20, March 2020 (Figure 2).

According to Centre of Disease control and prevention (CDC), sometimes corona viruses that infect animals can evolve and make people sick and become a new human corona virus [3].

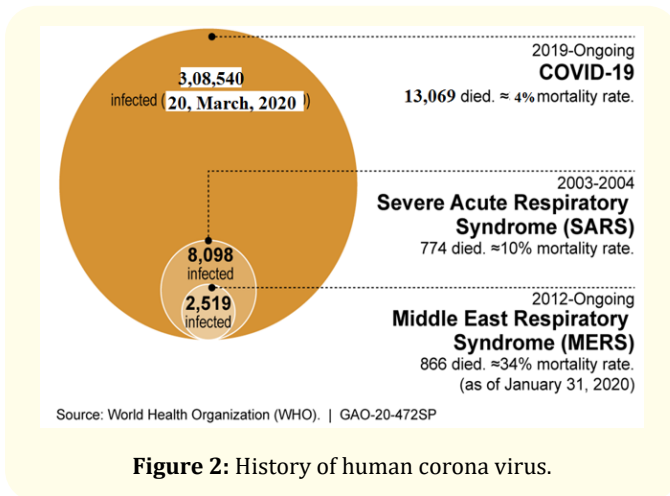


Figure 2: History of human corona virus.

Uniqueness of SARS-CoV2

Genomic organization of SARS-CoV 2

The single stranded RNA sequence of SARS-CoV2 consist of genes encoding five specific proteins- S (spike), M (membrane), E (envelope), N (nucleotide or RNA) and H (haemagglutinin esterase) that are responsible for causing infection within the host cell (Figure 3a and 3b).

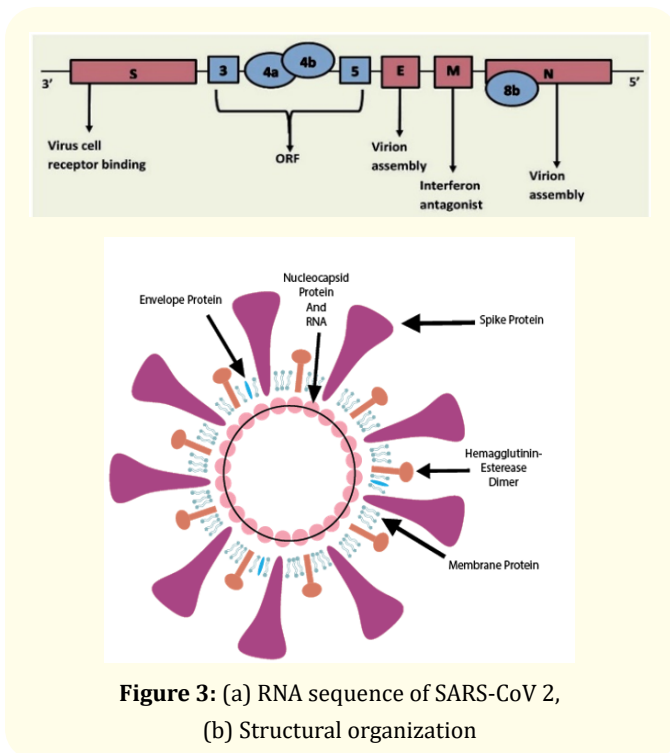


Figure 3: (a) RNA sequence of SARS-CoV 2, (b) Structural organization

The virus is inactive till it enters inside the human cell. As the virus comes in contact with the host cell, the furin protein present on the cell membrane of the host cell, cleaves the S protein of the virus into S1 and S2. The S1 protein is the receptor binding domain that attaches to the AcE2 receptor present on the cell membrane of the host cell while the S2 protein is the spike stalk through which the binding of the virus the becomes 1000 times greater. The M

protein gives shape to the virus. After fusion with cell membrane, as the virus enters inside the host cell mucosa (respiratory tract) (pH 6.5 - 6.6), the E protein helps in the release of virus into the host. The H protein helps in the cleavage of mucosal membranes. Inside the host, the RNA of the virus is released and transcribed into mRNA by the N protein and this mRNA is translated into viral proteins that cause infection. The time taken from viral entry into the host till the formation of infectious proteins is 14 days after which it shows symptoms [1].

Mutable genes on novel viral RNA

In previous SARS-CoV, the S2 protein was found to be inactive, but in SARS-CoV 2, this protein is active, therefore becoming 1000 times infectious than SARS-CoV. This is due to the presence of certain mutation genes on the viral RNA, that are responsible for causing mutations of the RNA sequence of this novel corona virus and thus activating the S2 protein. According to a study by Decroly 2020, the novel corona virus confirms that this virus has mutation genes, thus showing infection pathway similar to that of HIV. This unique feature of SARS-CoV2 has made it difficult to generate a vaccine [4].

Therefore, the most important way to prevent the infection is to remain isolated from crowded places, avoid physical contacts and washing hands using sanitizers as the only mode of transmission of disease is from an infected person to another person. The disease is fatal for people with weak immune system, old-age and children.

On-going clinical trials to synthesize vaccine

According to a study by Fauci, 2020, clinical trials for the development of COVID-19 vaccine is still being carried out. This vaccine is named as “mRNA-1273” that targets the spike protein of the virus. This will be a faster way to treat COVID-19. It will take approximately two months more for the availability of vaccine into the markets [5].

Another study by Raoult 2020, showed that combination of chloroquine phosphate (anti-malarial drug) and hydroxychloroquine has positive results in preventing COVID-19. The trials are still being going on which will approximately take one month time to get confirmed [6].

Conclusion

The current pandemic caused by SARS-CoV 2 (the novel corona virus) shows some mutable genes in its mRNA sequence. This feature had made it difficult but not impossible to synthesize a vaccine. The clinical trials for the vaccine preparation is still being carried out at a faster pace in countries like USA, China and France. But it will take some time (more than a month) for the vaccine to come into effect in the markets. Therefore, as the responsible citizens it is our duty to keep one-self and others safe from spreading

the disease by taking certain precautionary measures and avoid rumors. Be safe, Be healthy!!!!

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